

REMARKS

Claims 1-17 are pending in the present application.

The rejection of Claim 1 under 35 U.S.C. §102(b) over Menegoli (U.S. Patent No. 6,133,107) is respectfully traversed.

The present invention provides, *inter alia*, a semiconductor substrate comprising:

a lightly doped substrate that contains impurities at a low concentration;
a heavily doped diffusion layer entirely covers a top of the lightly doped substrate and is higher in impurity concentration than the lightly doped substrate; and
an epitaxial layer which entirely covers a top of the heavily doped diffusion layer and contains impurities at a lower concentration than the heavily doped diffusion layer (see Claim 1).

From the foregoing, Applicants submit that it is clear that the semiconductor substrate of the present invention is formed of three superposed layers, i.e., a lightly doped substrate, a heavily doped diffusion layer and an epitaxial layer. The heavily doped diffusion layer entirely covers a top of the lightly doped substrate, and the epitaxial layer entirely covers a top of the heavily doped diffusion layer.

The Examiner cites Menegoli in rejecting Claim 1 and alleges that "Referring to figures 12-14, Menegoli *teaches* a semiconductor substrate comprising:

a lightly doped substrate (50, P-) that contains impurities at a low concentration;
a heavily doped diffusion layer (54, N+) which entirely a top of the lightly doped substrate (50) and is higher in impurity concentration than the lightly doped substrate; and

an epitaxial layer (60) which entirely covers a top of the heavily doped diffusion layer and contains impurities at a lower concentration than the heavily doped diffusion layer.”

In contrast to Examiner’s allegation, Applicants submit that Menegoli does not disclose the semiconductor substrate of the present invention. Specifically, the Examiner attention is direct to the fact that Figs. 12-14 are shown at a larger scale than Figs. 4-11 (see Column, 6, line 10). When Figs. 6-14 are interrelatedly reviewed, it is clear that Figs. 12-14 show a portion of the device shown in Figs. 6-11. Also, it is clear in Figs. 6-11 that the heavily doped diffusion layer 54 of Menegoli is a buried region formed on a portion of the substrate 50. In other words, the heavily doped diffusion layer 54 disclosed by Menegoli does not entirely cover the substrate 50. Therefore, it is clear that the heavily doped diffusion layer 54 disclosed by Menegoli does not correspond to the heavily doped diffusion layer recited in Claim 1 of the present application. The heavily doped diffusion layer recited in Claim 1 entirely covers a top of the lightly doped substrate and is higher in impurity concentration than the lightly doped substrate.

Further, Menegoli discloses a semiconductor device formed in a semiconductor substrate, not a structure of a semiconductor substrate *per se*. The present invention calls for a structure of a semiconductor substrate *per se*. Accordingly, for this additional reason the presently claimed invention is distinct from the disclosure of Menegoli.

The Examiner is reminded that in order for a reference to anticipate an invention, the reference “must teach every element of the claim” (MPEP §2131). As such, Applicants submit that Menegoli fails to anticipate the claimed invention.

In view of the foregoing, Applicants request withdrawal of this ground of rejection.

The rejection of Claims 10, 11, and 13 under 35 U.S.C. §102(b) over Adamic Jr. (U.S. Patent No. 6,124,179) is respectfully traversed.

The present invention provides, *inter alia*, a semiconductor substrate comprising:

a heavily doped diffusion layer which entirely covers a top of a lightly doped substrate and is higher in impurity concentration than the lightly doped substrate, the lightly doped substrate being removed at a final stage of a process; and

an epitaxial layer which entirely covers a top of the heavily doped diffusion layer and contains impurities at a lower concentration than the heavily doped diffusion layer, wherein an impurity diffusion layer for forming a semiconductor device is formed in the epitaxial layer (see Claim 10).

The Examiner cited Admic Jr. in rejecting claims 10, 11 and 13 and states that “Referring to figures 2a-2d, Admic Jr. teaches a semiconductor substrate comprising:

a heavily doped diffusion layer (N+) which entirely covers a top of a lightly doped substrate and is higher in impurity concentration than the lightly doped substrate, the lightly doped substrate being removed at a final stage of a process; and

an epitaxial layer (N-) which entirely covers a top of the heavily doped diffusion layer (N+) and contains impurities at a lower concentration than the heavily doped diffusion layer, wherein an impurity diffusion layer for forming a semiconductor device is formed in the epitaxial layer.—”

Applicant and note that the Examiner identifies the N+ layer 201 as the heavily doped diffusion layer (N+), and the N- layer 210 as the epitaxial layer (N-). In other words, the Examiner identifies the N+ layer 201 of Admic Jr. as corresponding to the heavily doped

diffusion layer recited in claim 10, and the N- layer 210 of Admic Jr. as corresponding to the epitaxial layer recited in claim 10. However, this identification by the Examiner is incorrect.

Specifically, claim 10 recites that “a heavily doped diffusion layer which entirely covers a top of a lightly doped substrate …”. Contrary to the recitation of the heavily doped diffusion layer of claim 10, the N+ layer 201 of Admic Jr. comprises a wafer *per se* and does not cover any layer. In relation to this point, Applicants note that column 8, line 1 of Admic Jr. states that Fig. 2(a) shows a low resistivity N-type silicon wafer 201. Thus, the N+ layer 201 of Admic Jr. does not correspond to the “heavily doped diffusion layer which entirely covers a top of a lightly doped substrate …” recited in claim 10. Consequently, the N- layer 210 of Admic Jr. does not correspond to the “epitaxial layer which entirely covers a top of the heavily doped diffusion layer” recited in claim 10, either.

Further, Admic Jr. discloses a semiconductor device formed in a semiconductor substrate, not a structure of a semiconductor substrate *per se*. The present invention calls for a structure of a semiconductor substrate *per se*. Accordingly, for this additional reason the presently claimed invention is distinct from the disclosure of Admic Jr. Admic Jr. does not disclose a semiconductor substrate formed of three superposed layers as recited in proposed claim 1 of the present application.

The Examiner is reminded that in order for a reference to anticipate an invention, the reference “must teach every element of the claim” (MPEP §2131). As such, Applicants submit that Menegoli fails to anticipate the claimed invention.

In view of the foregoing, Applicants request withdrawal of this ground of rejection.

The rejection of Claims 2-5 and 12 under 35 U.S.C. 103(a) over Menegoli (U.S. Patent No. 6,133,107) or Adamic Jr. (U.S. Patent No. 6,124,179) in view of the applicants

alleged admission of the Prior Art on pages 1-4 of the present specification is respectfully traversed.

Menegoli and Adamic Jr. are discussed above and each fails to disclose or suggest a semiconductor substrate meeting the limitations of independent Claims 1 and 10. The alleged admission of the Prior Art on pages 1-4 of the present specification is cited as showing that lightly doped substrates contains phosphorus or boron and that the resistance of the epitaxial layer is $10 \Omega\text{cm}$ or less. However, this citation fails to compensate for the aforementioned deficiencies in the disclosures of Menegoli and Adamic Jr. Therefore, Applicants submit that the combined disclosures of Menegoli or Adamic Jr. with the alleged admission of the Prior Art on pages 1-4 of the present specification fails to render the present invention obvious.

Accordingly, withdrawal of this ground of rejection is requested.

Finally, with respect to the non-elected method claims, Applicants remind the Examiner that MPEP §821.04 states:

...if applicant elects claims directed to the product, and a product claim is subsequently found allowable, withdrawn process claims which depend from or otherwise include all the limitations of the allowable product claim will be rejoined.

Accordingly, upon a finding of allowability of the elected product claims, Applicants respectfully request rejoinder of the withdrawn process claims that depend therefrom.

Application Serial No. 10/713,054
Reply to Office Action mailed October 30, 2006

Applicants submit that the present application is now in condition for allowance.

Early notice to this effect is earnestly solicited.

Respectfully submitted,

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